Flash Memory Summit

Implementing Computational Storage with Existing SSD Controller Resources

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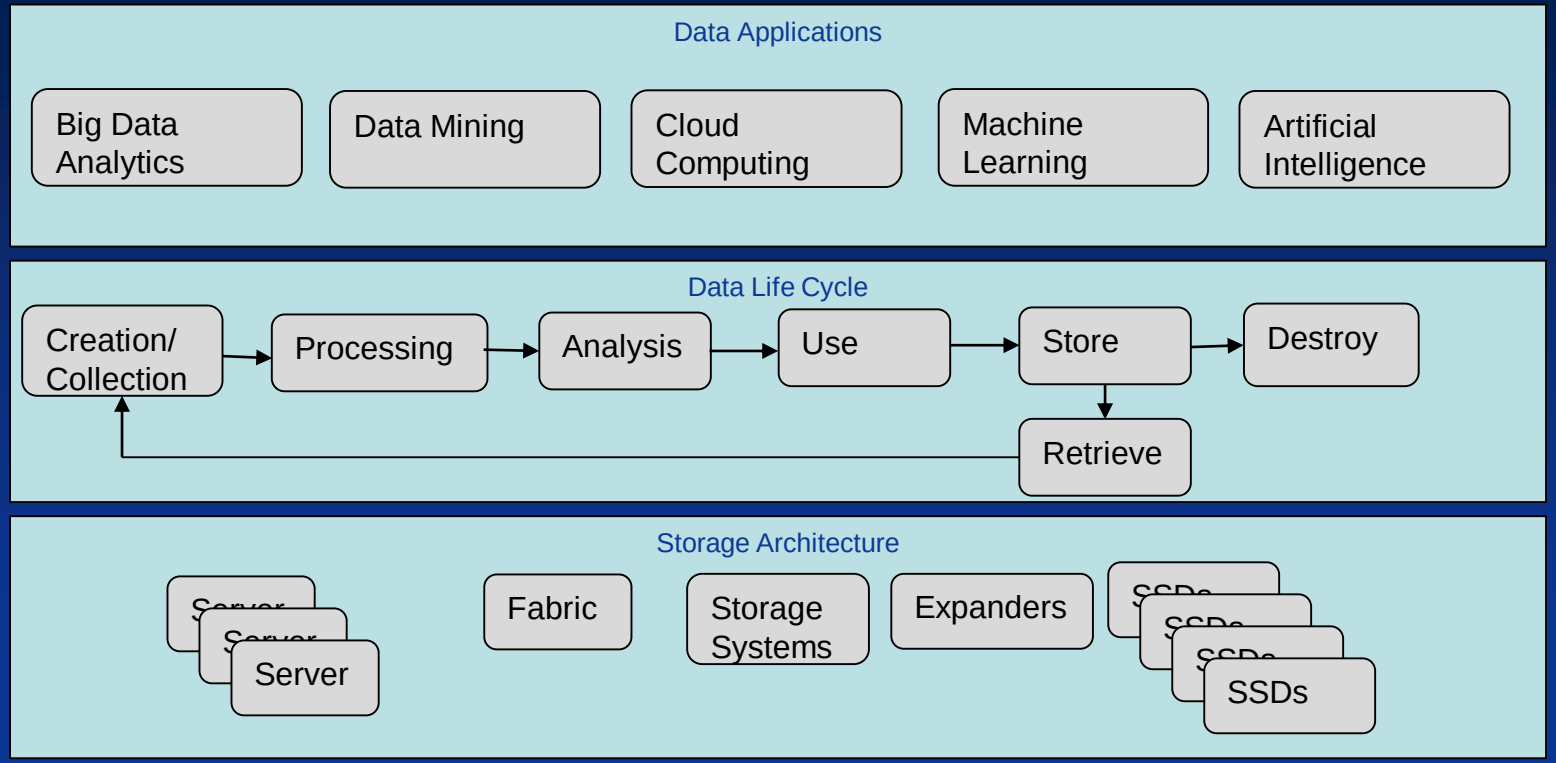
Agenda

- Abstract
- NVMe SSD Resources
- Computational Storage Examples
- Data Processing Offload Engines
- Data Processing Offload Analysis
- Summary

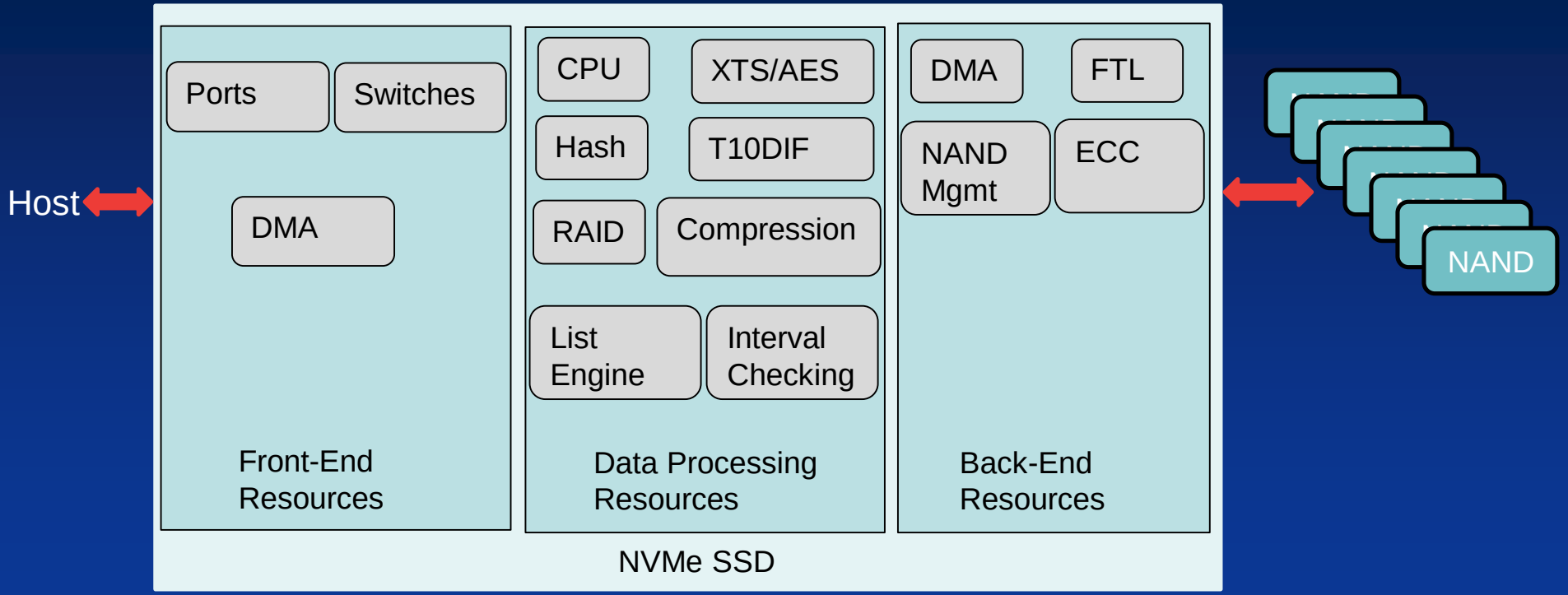
Abstract

- Computing and storage needs are ever expanding in enterprise applications. NVMe™ SSD controllers are evolving in functionalities and incorporating various computing resources such as multiple co-processors, hardware accelerators, additional memories, peripherals, etc.. However, these computing and storage resources within an SSD may not be utilized at all times. These resources may be leveraged to offload the host CPU or remote CPUs to improve the overall system performance and TCO. The NVMe standard also provides mechanisms to take advantage of these resources with compute ability.

Why Computational Storage?

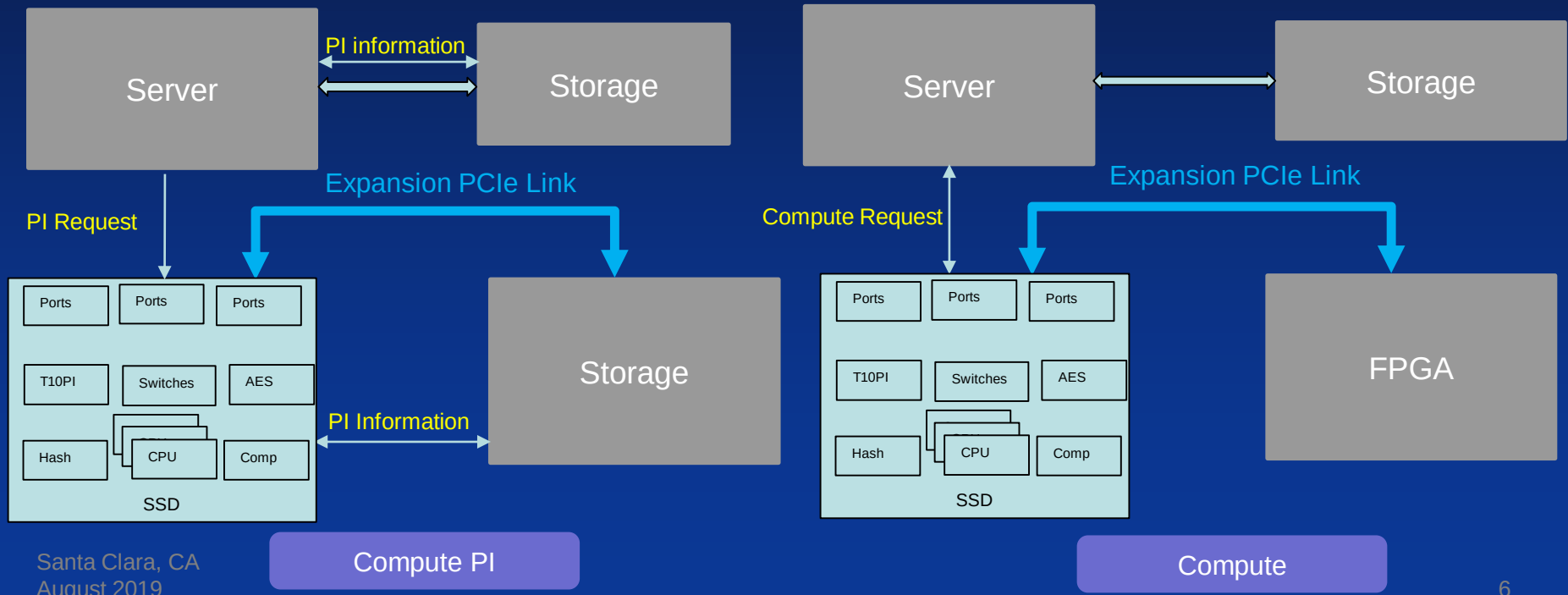


NVMe SSD Resources



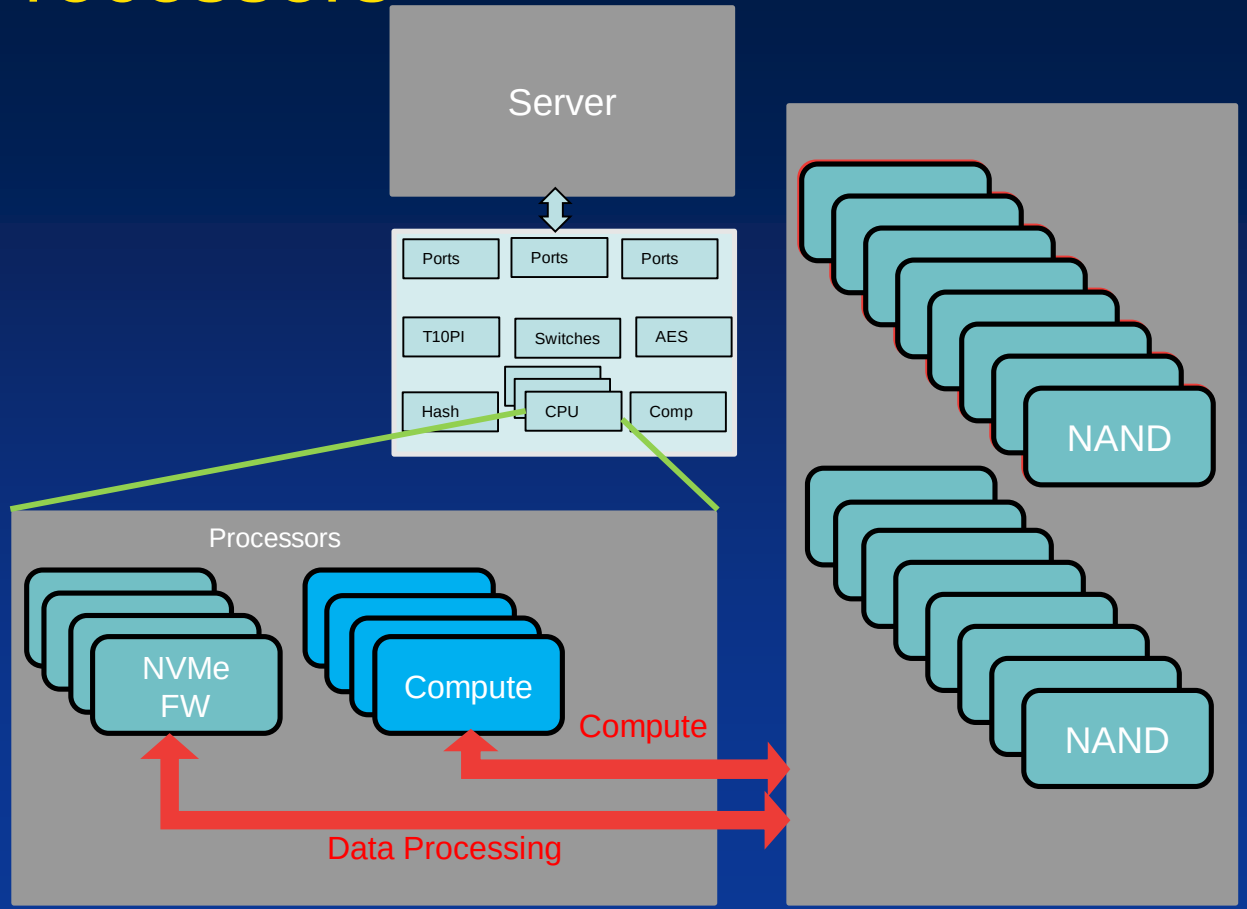
Port Resources

- SSDs may have multiple ports including Expansion PCIe® to connect additional devices or augment the SSD capabilities. These resources can be used for computational storage.



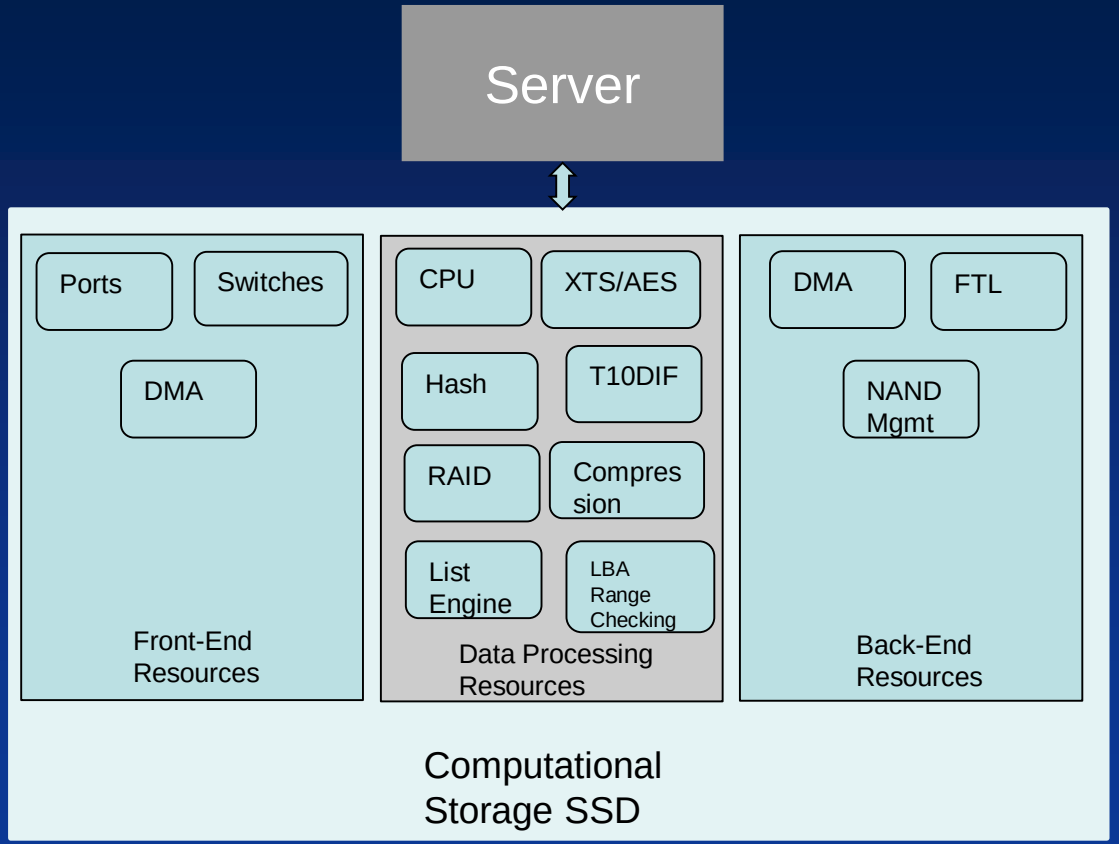
Multiple Processors

- With the trend in reduced silicon geometry, SSD controllers are integrating more CPUs than are always needed for traditional SSD applications.
- Computational storage SSDs typically have 4-16 high-speed processor cores.
- These processors can be used for various compute operations such as image processing, data analytics, AI, machine learning, deep learning, etc.

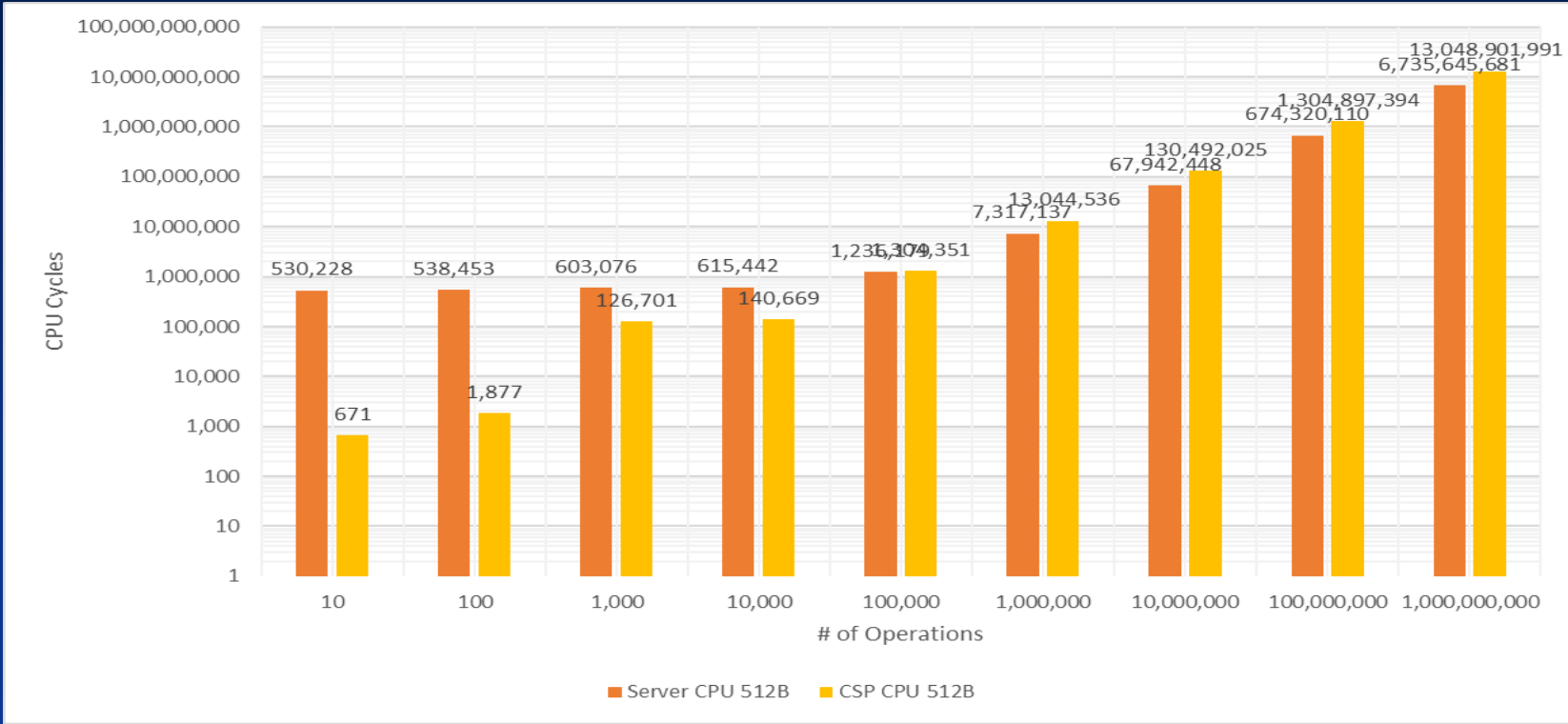


Data Processing Offload Engines

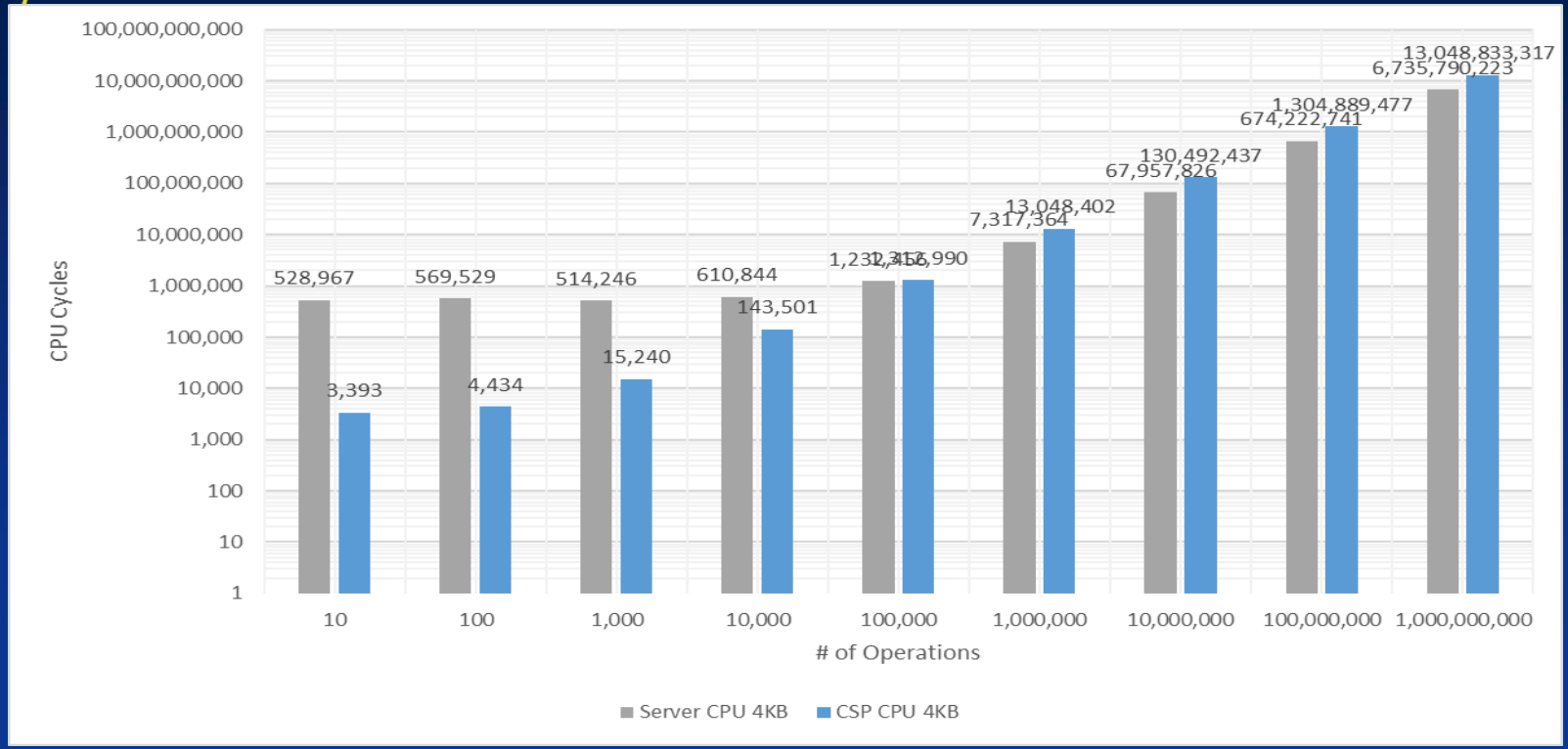
- Hash engine
  - Key-value store applications
  - Authentication
  - Data searching
- XOR engine
  - Perform RAID parity
- Compression engine
  - Data compression for improving NAND endurance
- Encrypting/decrypting engine
  - Protection of data is becoming more critical
- Other offload engines
  - E.g., linked list, LBA range checking, etc.



Data Offload Analysis – 512B



Data Offload Analysis - 4KB



Summary

- Newer NVMe SSD controllers are incorporating various computing resources such as multiple co-processors, hardware accelerators, additional memories, peripherals, etc.
- These resources may be leveraged to offload the host CPU, or remote CPUs in a Fabric topology to improve the overall system performance, TCO
- Computational storage SSD is one of the building blocks of composable platforms

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Thanks!!

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